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The price of sugar in New York at latest date was 4⅜ cents. There is still much uncertainty regarding the shortage of the European beet sugar crop. The future price depends largely on this.

The yield of sugar in the Island of Cuba for the coming season will be but a bare 200,000 tons, the smallest crop ever known to the memory of the oldest planter. This estimate is based upon a careful survey of the situation by the best authorities in Havana, and may be depended upon as accurate in so far as a forecast by experts is possible to be.—Louis. Planter.

Nearly all the sugar mills in this group are now in active operation, and the prospect is good for a crop fully up to the estimates. The weather so far has been favorable, though the season for southerly storms has not passed yet. The facilities for rapid harvesting and grinding were never so good as they now are. The only new plantation that will commence grinding during the spring of this year is the Oahu, the machinery of which is now being placed in position.

Dr. Morris, recently assistant manager of the Royal Gardens, at Kew, London, has been appointed commissioner of the British Department of Agriculture for the West Indies. His headquarters will be at Barbadoes, where he is now located. His special work will be to study the needs of the agricultural interests of the group, and report on the best way to relieve the sugar and other industries, which are now very greatly depressed, and call for government assistance.

A bill appropriating $50,000 a year for four years, to pay a bounty of $1 per ton for sugar-beets harvested in the State for the purpose of being manufactured into sugar, has passed the Oregon House, 33 to 24. During the debate one representative, speaking in opposition, quoted a sugar authority for the statement that, in view of the recent territorial expansion of the United States, it was not too much to say that cane sugar could soon be laid down in this country at an expense not exceeding 1 cent per pound.

Advices received from Washington by Byron O. Clark, of the Bureau of Agriculture, relative to the fungus which has appeared, on some of the coffee plantations of Hawaii, recommend spraying the trees which are affected with this blight. The mixture calls for fifty gallons of water, in which six pounds of copper sulphate and four pounds of strong fresh lime have been dissolved, by thorough stirring. If this proves to be too strong, it can be diluted with the addition of more water. The hand-power pumps are recommended as the most useful apparatus for spraying.

"Thrum's Annual" is an ever-welcome visitor, which no business man can dispense with. It furnishes the latest statistics regarding these islands that can be had—in fact, it is "up to date." The most interesting portion this year is the sketch of "Old Honolulu," prepared by the late Warren Goodale, supplemented with Emmet's lithograph views of notable places in the then village, as they were sketched in 1853. The original framed pictures were presented to the Historical Society by Mr. Goodale and are now in its possession, forming one of the most interesting mementoes of Honolulu, as it then was.

Our imports from the United States are far more than from any other country in the world, says the London Grocer. Thence we receive every year millions of pounds' worth of living animals; of bacon, of beef, mutton, and pork, of canned meats, fish, and fruit, of butter, cheese, lard, of tallow, stearine, oilseed cake, of petroleum, of wood, of tobacco. Then there is the staff of life itself in the shape of wheat, maize and flour. Of those prime articles of daily food the United States is our greatest source of supply. Roughly speaking, we grow at home only about a quarter of the wheat and flour we consume; for the remaining three-fourths of our needs we have to look abroad.

The latest estimates of the Louisiana sugar crop, says Willett & Gray's Statistical, "have increased considerably and crop reports are rather more encouraging, though not favorable. The acreage is larger than last year, but the yield of sugar is very much smaller and is not likely to improve, and the cane has received some damage from rain and frost. We do not yet change our estimate of 270,000 tons for present crop, but much depends still upon the weather during the remainder of the campaign. All detailed returns from the last crop are not yet in, but will be soon and will be published by Mr. Bouchereau, as usual. The latest reports indicate a crop of about 310,000 tons last year (1898)."

As will be seen by the following notice, Dr. Maxwell, of the Hawaiian Experiment Station, having been appointed special agent in these islands for the United States Department of Agriculture, all communications for that department may be sent through him.

United States Department of Agriculture,
Office of Special Correspondent, Hawaiian Islands.

Honolulu, December 28th, 1898.

Where information is required, or in communication with, or in despatching matters to, or receiving matters from the Department of Agriculture of the United States Government, the public may consult with the local office established by the Secretary of Agriculture. This office is commissioned to take cognizance of any report upon the Agriculture of the Islands, embracing sugar, rice, coffee, vegetables and fruits, medicinal plants, cereals, ranches, dairies and forests. A first report on Hawaii has to be included in the Annual Report of this year of the Secretary of Agriculture to the President of the United States.

WALTER MAXWELL.
Hon. Special Agent and Correspondent for Hawaii.

The Journal of the Jamaica Agricultural Society for October remarks:—"Budding the mango has been generally considered an impossibility, but this is a mistake because it is done by experts in Florida, and it can be done by others when understood. The secret lies in taking the buds from about the middle of the growing shoot where they are well developed, and yet not too tender—where the color of the bark is just turning from green to purple—and at a time just prior to a vigorous stage or growth in the tree to be budded. The shield method has been used, but I believe the ring or plate style would be better."

The Ceylon Government has provided, at the instance of the Planters' Association, for a salary of 5,000 rupees a year, with a house for an entomologist. The Governor states in his official message, that "it is not contemplated that the very suitable gentleman whom it is proposed to appoint will permanently assume duties before the middle of September." Mr. E. E. Green, at present Honorary Entomologist to the Government of Ceylon, is the gentleman referred to. His appointment will, no doubt, be widely approved in Southern India, as he has always manifested readiness to assist planters in these parts as well as those of Ceylon. In particular, the subject of the importation of lady-birds for the extermination of scale pests has received and is still occupying his attention. This is a subject in which Southern India is greatly interested.—Madras Planting Opinion.

Secretary Wilson, in his annual report of the Department of Agriculture, for 1898, referring to Hawaii, says: "In the territory recently brought under the control of the United States Government, the agricultural interests urgently call for attention by this department. Hawaii and the West Indian Islands depend almost exclusively for their prosperity upon their agricultural productions. It behooves the department, therefore, to place itself at the earliest moment possible in a position to extend to agriculturists of those territories which have, or may, come under the United States flag, the services and benefits it renders to the farmers of the United States. The increased trade relations that may be looked for between the United States and its insular dependencies, moreover, render the conditions of agriculture in the latter, and the character and extent of their productions, matters of profound interest to the people of the United States. It is urgently necessary that Congress should as speedily as possible provide a sufficient fund for the use of this department in making such investigations as may be necessary into the agricultural resources and conditions in Hawaii, Porto Rico, Cuba and the Philippines."

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THE LOUISIANA SUGAR INDUSTRY.

The sugar crop of Louisiana for 1898 has again fallen below the expectations of planters, owing chiefly to drought and early winter frosts. Both these causes have long existed as hindrances to an expansion of this industry there, as droughts checked it here in Hawaii, previous to the discovery of artesian water, which has rendered the industry more reliable. Prior to its discovery in 1878, the yield of sugar here never exceeded 25,000 tons a year, and probably never would have reached 100,000 tons, unless in exceptionally wet years. The crop of 1880, the year after the discovery of artesian water was less than 30,000 tons. But from that date, with its help, there has been a steady increase, till now it exceeds 200,000 tons annually.

Louisiana has been always subject to periodical summer droughts, when nature calls for a steady supply of moisture to assist the plants, and insure a steady normal growth. Yet, with numerous streams which might be tapped, we are not aware that irrigation has ever been resorted to there, in cane culture, except in the experimental gardens. Why this has not been done, we have no means of knowing, but that it has been referred to, the following extract from Louisiana Planter is evidence:

"Admitting all of these difficulties, admitting that Louisiana has an exceptional rainfall and should therefore probably suffer less from drought than other agricultural countries, at the same time we have in mind the crop year of 1890, during which year the rains on the sugar plantations of Louisiana fell so nearly when and as they were wanted that the sugar crop of 1889 of 144,000 tons was followed by a crop in 1890 of 252,000 tons. The distribution of the rainfall on the sugar plantations of Louisiana in 1890 was ideal. Every sugar planter seemed to have got just the rains he wanted, and the results showed up in an immense crop; black clay lands that ordinarily do well to yield 20 tons of plant cane, having given that year 35 tons. * * * We must say that we still believe that Louisiana will, in the future, utilize even better than now the heat and sunshine of her climate by supplementing the moisture supplied by nature with some supplied by art, when nature fails to furnish the desired quantity. Active vegetable life requires a competent supply of light, heat and moisture. Should the moisture be inadequate, the growth of the plant becomes less rapid. If the moisture be in excess, bad results follow, but any proper plan of irrigation would restrict an artificial water supply to just the quantity needed by the plants."

To mature perfect sugar cane, rich and abundant in saccharine qualities, demands a steady and unchecked growth of the plant, from the time it shows its first leaves till it reaches its full growth. Any check during this period, be it from lack of moisture or from frost injures its commercial value. Now a rapid, steady and continuous growth can only be insured by irrigation or rainfall. If the latter is uncertain, then the former should be provided. Its cost is considerable, but once made, it insures a paying crop, generally maturing before the occasional early frosts.

The situation in Louisiana is somewhat similar to what it was in Hawaii in the seventies, poor and varying crops, depending on alternate rain, and drought, with two or three tons of sugar per acre. Expensive artesian water has rendered cane-culture a success here, and expensive irrigation supplies will insure its success in Louisiana. At least such is our belief.

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BEET SUGAR IN ENGLAND.

The latest issue of "The Sugar Cane," the December number, is almost entirely given up to the results of over one hundred experiments made in various parts of England and Scotland with sugar beets, and these results are so extraordinary, that the indications are extremely favorable to the success of the beet sugar enterprise there. If sugar beets can be so successfully grown in Norway and Sweden, that those two northern countries are now wholly supplied with domestic sugar, we see no reason why the same results may not be had in

England, Scotland and Ireland. The following statement is from the Birmingham Gazette:

Put briefly, the roots grown have been surprisingly large in size, and like those grown in Dr. Schnack-Sommer's experiments, about one-third larger than the German average this season. As a rule, sugar factories do not like roots too large, but the reason for this is because in Germany (and in the United States) very large roots are generally found to be deficient in sugar, and clumsy and deformed in shape. This objection would not apply to roots grown in this year's experiments, because, although, large, they are well-shaped and exceptionally rich in sugar. In this latter matter they surpass expectations, the average of saccharine matter in the roots attaining 16.40 per cent., as against 14.90 per cent., the average in the German roots grown this year. The "quotient of purity" is also higher in the British roots generally than in the German.

The yields per acre and cost of growing are also satisfactory, the general average being a little over 15 tons per acre, and the cost of growing a little under £10. This is practically the same as the estimate made beforehand by Mr. Stein. A point upon which some details are still wanting is the quantity of sugar produced per acre. The indications are that for the whole of the experiments this will average somewhere about 2 tons 10 cwt. per acre, or nearly a ton more than the average of Germany. This, of course, is not all extracted in manufacture, but it clearly shows the high quality of the roots of sugar contents.

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Oh, youth can make feasts of the coarsest of viands
And never again shall we veterans feel
Such a zest in our lives as 'way back in the 6o's,
When a hardtack sufficed to create a "square" meal.
Though now we may dine at more sumptuous tables,
We'd gladly exchange all the dainties they yield
For the hearty enjoyment, the youthful digestion
That seasoned the hardtack we ate in the field.
The bullet-proof hardtack!
The iron-clad hardtack!
The old army hardtack we ate in the field!

—New York Mail and Express.

MOLASSES AS A FERTILIZER.

TO THE PLANTERS OF HAWAII:—GENTLEMEN:

In addressing you I have the pleasure of calling your attention to the success I have had in converting the waste molasses of your factories into a highly productive fertilizer. After many failures and disappointments by me, as well as by others who have tried to solve this problem, I am happy to state that I am prepared to furnish you with the details for the preparation of a valuable revival of especially poor soil. Although the analysis of this product shows a low percentage of ammonia and other fertilizing agencies, it nevertheless becomes a highly reviving agent when put through the natural process of putrefactive fermentation, which is incessantly at work in the soil.

The molasses contains a high percentage of nitrogenous food, as albumen. Now as ammonia is given out by decay, it stands to reason that this process should go on in the soil itself and not in a compact pile, as ammonia is such a highly volatile gas, that, unless retained and held in combination with the soil by some intermediary agency it is lost and condensed by aqueous vapors.

A ton of waste molasses is equally as valuable to you as a ton of sugar. The continual use of stimulating fertilizers will bring the soil soon to a state where it calls for repleniishment, and there is no better or cheaper article than waste molasses. It is removed from the soil and should be returned.

The above assertions are not made from a theoretical standpoint alone, but it has been fully demonstrated in a practical way on Kahuku plantation, where the most flattering results have been obtained.

In spite of the large increase in the use of artificially prepared fertilizers, there has been a decrease in the return of sugar per acre last year on these islands. This may be attributed to some other influences, but these symptoms have shown in a very marked degree in other sugar producing countries, especially in Germany.

This preparation of molasses is a pure manurial substance. It loosens the earthy particles, and attracts moisture; but its chief recommendation is its cheapness.

For further particulars, apply to

GUS FROBOESE,
Kahuku Plantation, Oahu.

THE INFLUENCE OF CERTAIN BODIES ON THE EVAPORATION OF SUGAR SOLUTIONS.

(By J. T. Crawley, First Assistant Chemist, Hawaiian Experimental Station.)

In the report of Dr. Maxwell of this station for 1897 (see Planters' Monthly, Vol. XVI, No. 12, p. 568) we find these words: "We would call attention at this place to the very dissimilar work done by the same effect, under the same contingent conditions, but with different qualities of juice. The causes of this variation are almost strictly chemical, and are due to the variation in kind and amounts of the impurities in cane juices. It is well known that these several kinds of impurities have an influence, in different degrees, upon the crystallization and recovery of the sugar; we are sure that these bodies are equally potent in lessening the rate of evaporation. We have a series of experiments in evaporation planned, in order to determine the different action of the impurities—glucose, amides, gums and mineral matter—upon the rate of evaporation. This work was planned for carrying out when the writer was engaged in work with Dr. Stubbs, at Audubon Park; but it was not possible to execute it. We believe that such exact data will be of daily value to the person in charge of the sugar making, and will also help to correct errors, in which fault is laid to the evaporator, when the cause is in the juice."

The time necessary to boil a "strike" of sugar varies greatly with the quality of the solution being evaporated. When the cane is mature and of high quality, the time of evaporation is much less than when the cane is immature and of low purity. The average time of boiling on these islands might be put at 3½ to 4 hours, while it is much greater in Louisiana, reaching in extreme cases 15 to 20 hours.

Not only this, but neighboring plantations, using the same make of machinery, will often require very different time for evaporation. The object of this investigation is to locate the cause of this variation.

The subject was approached under two heads:

(1) Does it require a different number of units of heat, or a different quantity of heat, to evaporate a given quantity of water, according as the solution is more or less pure?

(2) What is the effect of the impurities on the *time* of evaporation?

Plan of the Experiments: Place the solutions to be experimented upon, heated to or near the boiling point, in a well-insulated vessel and note the loss of heat, or fall in temperature, corresponding to a given removal of water from the solution by evaporation. From these data, the *units of heat* absorbed by the evaporation of a unit of water, can be calculated for various temperatures below the boiling point. Note also the *time* required for this evaporation of a given weight of water from the solution. In this way a comparison of various solutions may be made.

The difficulties of making these experiments *at* the boiling point, either in open air or in vacuum, to correspond with sugar house work, will be appreciated. The first would require an unvarying source of heat; the second both an unvarying source of heat and a constant vacuum, which are next to impossible in the limitations of laboratory experiments, neither are they attained in practical sugar house work.

But in the manner thus outlined, results can be obtained which are strictly comparable with each other at any desired temperature below the boiling point, and which, we believe, will be comparable with those results obtained at the boiling point.

E. Peclet (see Foster on Evaporation, p. 224) says: "In all cases, whether or not the liquid reaches the boiling point, it is generally admitted that the quantity of heat necessary for the evaporation is the same, etc., etc."

Apparatus The following apparatus is essentially that used by E. Peclet (1 oc. cit. supra) and Box (see Thomas Box, A Practical Treatise on Heat, p. 150) in their determination of the quantity of heat necessary to evaporate given quantities of water at temperature below the boiling point, the only differences being that we have secured a more perfect insulation of the apparatus, and also used a mechanical stirrer in order to have a uniform temperature throughout the vessel. A cylindrical copper vessel, one-half square foot surface, and 3¼ inches deep, was placed in another of greater dimensions, leaving about one inch between the sides of the two vessels. After repeated trials with different insulating materials, the vessel was finally insulated as follows: A cylindrical piece of asbestos into which the vessel holding the solution would fit, was placed within the larger vessel, and the walls between the asbestos and the outside copper vessel filled with small bits of cork. A layer of bits of cork was placed over the bottom ¾ inch thick and sheet asbestos upon this. Finally the whole apparatus was incased in felt. This insulation seemed to be as perfect as was possible, and was retained throughout the experiments.

Method of Working: The inside copper vessel was removed, filled with the solution to be tested, heated to the boiling point and at once transferred to the insulator. The whole apparatus was then placed on a very sensitive Fairbanks scales, capable of weighing accurately to ½ gram. Into this solution was introduced a thermometer by which the temperature of the solution was taken at successive losses of 20 grams of water evaporated from the solution. At first the thermometer was used in stirring the liquid immediately before reading in order to have a uniform temperature throughout. It was soon noticed, however, that stirring had a great influence on the evaporation, so that it was deemed advisable to have a mechanical stirrer. The stirrer consisted of a small brass rod carrying a pulley at the upper part, and at the bottom two pieces of thin wire at right angles to the rod, and the two pieces of wire at right angles to each other, thus making four arms. These four arms were bent down and dipped into the solution at various distances from the brass rod support, and revolved by means of a motor at the rate of about one hundred revolutions per minute. Into the liquid a delicate thermometer was suspended, and readings taken at successive losses of twenty grams of water as shown by the scales, the time being taken at the same moment.

The following observations were made:

Table I—Units of heat and time required to evaporate 20 grams water from vessel of water at various temperatures.

Wt Water Grams.	Temperature.	Ave. Temperature.	Loss of heat, Degrees.	Time of Evaporation Min. Sec.	Units of heat per gram water.
2610	90.2	......	......	......	......
2590	36.0	88.1	4.2	1:30	557
2570	81 3	83.6	4.7	2:20	618
2550	76 5	78 9	4.8	2:50	627
2530	71.3	73.9	5 2	3:50	674
2570	66.0	68 6	5 3	5:20	682
2490	60.6	63.3	5 4	7:00	689
2470	54 8	57 7	5.8	9:25	706
2450	48 7	51 7	6 1	14:45	766
2430	42.3	45.5	6 4	24:45	798

To the weight of water above given is added the thermal value of the copper container, 53 grams. The last column is calculated thus: 2610 grams of water at 90.2° C. lost 20 grams by evaporation while the temperature dropped to 86° C. The average weight of water, 2600 grams, increased by 53 grams for the container.

2653×4.6÷20=557, the total heat units lost per unit of water evaporated. Therefore at 88.1° C. 1 gram water requires 557 units of heat for its evaporation under the conditions of the experiment. This test was duplicated, and a curve drawn using the temperature as one co-ordinate and the units of heat lost as the other. Tests were made in precisely similar manner with solutions of pure sugar, confectioners' glucose and gum arabic, all the curves drawn and in a line run through the curves at 75° C. in order to observe the heat lost at the same temperature.

Table II, showing heat lost in evaporating one gram of water from solutions at 75° C.

Strength of solution per cent.	Pure Sugar.	Glucose.	Gum Arabic.
65	1095	1122	...
50	895	.	....
40	750	842	....
30	....	762	875
25	747	....	....
20	738	745	735
10	695	710	675
5	....	..	677

It will be seen that a low density the heat of evaporation is practically the same for the various bodies, that this increases with the density, and at high densities it is very much greater than at low densities; also that at high densities glucose requires very little more heat than sugar solutions, but that gum arabic requires more heat than either.

In order to observe the effect of stirring, or of a good circulation upon the evaporation of the above solutions, they were tested but without stirring, except that before reading, the solutions were quickly agitated in order to equalize the temperature throughout the mass.

Table III, showing the effect of circulation upon the heat of evaporation:

Strength of Solution........	SUGAR.			GLUCOSE.			GUM ARABIC.		
	With Stirring	Without Stirring......	Difference...	With Stirring	Without Stirring......	Difference....	With Stirring	Without Stirring....	Difference....
65 pr. c.	1095	1460	365	1128	1900	772	....	....	....
50 "	895	..	....	....	....	....	....	....	....
40 "	750	768	18	842	887	45	....	....	....
30 "	....	....	...	762	....	....	875	915	40
25 "	747	763	16	....	....	....	....	....	....
20 "	738	755	17	745	760	15	735	822	87
10 "	695	705	10	710	745	35	675	782	107

Stirring affects the evaporation considerably even at low densities, while at high densities this difference is enormous, especially in the case of glucose solutions. The test with gum arabic solutions could not be made owing to its viscious nature, and the ease with which it decomposed by heat.

The heat lost in the above evaporations is lost in the following ways:

1. In dissociating the water from the substance in solution.

2. In evaporating this water.

3. By radiation from the vessel due to incomplete insulation.

4. By radiation from the surface of the liquid and by warming air currents.

From a theoretical consideration, the heat lost is dissociating the water from the substance must be small or nothing, since the heat required would be equal to the heat given off by these several substances during their solution, which is very small, if anything at all. As the vessel was well insulated, little heat was lost from this source. Inasmuch as the heat absorbed by water during its evaporation is a constant quantity, no matter from what source the water is derived, depending upon the temperature at which the evaporation takes place; however, it follows that the differences required in heat in the above tests are due almost exclusively to the radiation from the surface of the liquid and to the warming of air currents, and these latter are direct functions of the *time*; the greater the *time* of evaporation, the greater will be the total heat radiated from the hot liquids, and carried off in warm currents of air. Daily observations of the wet and dry bulk thermometers were made during these experiments and the hydroscopic moisture was remarkably constant, showing that different results could not in any way be attributed to the different conditions of the atmosphere.

Following are results of the tests showing the time of evaporation:

Table III: Time required to evaporate 20 grams of water from solutions at 75° C.

Strength of Solution.	Sugar.			Glucose.			Gum Arabic.		
	Stirrer M. S.	None M. S	Dif. M. S	Stirrer M. S.	None M. S.	Dif. M. S.	Stirrer M. S	None M. S.	Dif. M. S.
65 per cent.	7.15	16 30	9.15	6 35	24.35	18.00	......	......	......
40 "	3.50	4.25	.35	3.50	5.15	1.25	......	......	....
30 "	......	......	...	......	......	......	4.13	9.50	5.20
25 "	3.40	4 35	.55	....	......	......	......	......	......
20 "	3.25	4 10	.45	3 25	4.15	50	4.20	6 20	2 00
10 "	3.20	3.50	.30	3 25	4 36	1.11	3.15	5.40	1.35
Pure water	3.12	......	.....	......	......	.. ..	..	....	.....

The variations in the time of evaporation resemble very closely the variations in the heat required for evaporation; for low densities the increase in time as the density increases is very slight, but for high densities the increase is very great. At low densities the time of evaporation for sugar and glucose is practically the same but higher for gum arabic. Again, agitation decreases the time of evaporation quite considerably, especially with gum arabic, while at high densities the evaporation seems to depend almost entirely upon the agitation.

Besides glucose and one of the gums, tests were made with the evaporation of 5% asparagine solutions, and water containing small quantities of salt, and in no case was the time of evaporation increased materially.

It is generally believed that alkaline solutions evaporate more slowly than neutral solutions, therefore to test this question as well as the effect of adding gum arabic and glucose, either separately or together, to sugar solutions, the following tests were made:

Table IV:

SUBSTANCE.	Heat Units.			Time to evaporate 20 grams.		
	Stirrer	None	Diff.	Stirrer M. S	None M. S	Diff. M. S.
38 per cent. sucrose, 2 per cent. glucose, 60 per cent. water......	822	845	23	3.15	4.30	1.15
36 per cent. sucrose, 2 per cent. glucose, 2 per cent. gum, 60 per cent. water	815	852	37	4.15	5.48	1.33
Same + 1 per cent. lime	821	860	39	4.00	5.00	1.00
7.8 per cent. glucose, 32.2 per cent. gum, 60 per cent. water	818	838	20	3.32	4.40	1.08
7.8 per cent. glucose, 27.2 per cent. sucrose, 5 per cent. gum	833	918	85	4.18	7 12	2 54
Same + 1 per cent. lime..........	830	872	42	4.36	5.45	1.09

In each case where both glucose and gum arabic are added to sugar the time of evaporation is increased, and lime increased this time when there is a large content of gum. This increase of time due to lime and gum, we are inclined to attribute not so much to the deterrent effect of these bodies *per se*, but rather to foam covering the surface of the liquid and preventing evaporation. All of the solutions used in these tests were inclined to foam at high densities, but the gum arabic and glucose were most liable to foam especially when lime was present. The glucose used in these tests was obtained by heating sugar solutions for a long time, when some of the sucrose was changed to invert sugar.

In order to test more fully the effect of these bodies when mixed, another series of experiments was planned, in which the solutions were maintained at 75° C. twenty minutes by means of a lamp underneath the vessel, and the loss in weight noted.

Substance.	Loss in weight, 20 minutes
Distilled water..	126
40 per cent sugar	99
30 per cent sugar, 10 per cent glucose	100
25 per cent sugar, 10 per cent glucose, 5 per cent. gum.........	74
Same + 1 per cent lime...................	74

This emphasizes the foregoing observation that gum in considerable quantity added to sugar and glucose retards evaporation.

The foregoing tests have very clearly brought out the fact that aside from the effect of impurities, the density of the solutions has a very great influence upon the rate of evaporation, and in order to get results from this point from a natural sugar juice some cane juice was obtained from the Experiment Station field, and after clarification and slight concentration, evaporated at 75° C. as in the preceding tests. This juice had a purity of 90, and the impurities were mostly non-sugars, the glucose content being very small.

Table V: Evaporation of Cane Juice at 75° C.

Brix of the Solution.	Water evaporated in 20 minutes.
(Pure Water)	(126)
23 1	107
31.5	101
37.5	100
47.4	85
56.0	74.6
65.5	40 5
72 5	34
77.5 (crystallizing.)	27

At 23.1 Brix the evaporation proceeded four times as rapidly as at 77.5 Brix, while at 72.5 the evaporation is one-fourth more than at 77.5. It might be said that in actual pan work as the density increases the temperature also increases, thus tending to equalize evaporation at the different densities. This is true to some extent, but it will not alter the figures given above very materially, as we have proved by direct experiment.

The key to the solution of the problem lies in the figures given. The density at which crystallization takes place increases with impurities present; to evaporate a given weight of water from the solution of high density requires very much more time than to evaporate the same weight of water from a solution of lower density. The time of evaporation or boiling, therefore, above all things else, depends on the density at which crystallization takes place, and also upon the rate of agitation at high densities. What effect the impurities, such as glucose, gums, amides and salts may have in retarding evaporation at or about the density at which sugar begins to crystallize, it is not now possible to say, as it was impossible to determine this by the methods used in the investigation. Again, we have not determined the precise effects that the different impurities may have in raising the density at which sugar crystallization takes place. These are now really crucial points, and would be taken up in their turn by the writer, but for the fact that he is leaving his present position in the Station.

The work, however, will be pursued by the Station, and under conditions it is expected, that will more nearly approach the practical work of the sugar-house.

The conclusions justified by the foregoing tests are:

1. At low densities, impurities affect the rate of evaporation but very slightly, and the evaporation proceeds equally in neutral or alkaline solutions.

2. As the density increases, gums retard evaporation, increasing with the density, while glucose alone affects it but little at any density.

3. Lime and gum added to solutions of high density decrease the rate of evaporation.

4. Whatever prevents a perfect circulation of the juice retards evaporation—slightly at low densities, but enormously at high densities of impure solutions.

5. The time of boiling a strike depends in a very large measure upon the density at which crystallization takes place.

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THE CONSERVATION OF SOIL MOISTURE AND ECONOMY IN THE USE OF IRRIGATION WATER.

(By E. W. Hilgard and R. H. Loughridge.)

The exceptionally dry season of 1897-8, coupled with the early cessation of rains in the spring of 1897, brought about in California a more extended failure of cereals and pasturage, and shallow-rooted crops generally, than in any year since the State became a prominently agricultural one, the season of 1876-7 being the nearest to carry with it a similar deficiency in crop production. It has been the effort of the Experiment Station to utilize the present unusual season for the study of the limits of endurance of drought on the part of the several crop plants, and with it to determine the minimum of water that will suffice for their satisfactory growth in the several soils. While far from completed, this work (involving many hundreds of determinations of moisture in soils) has already yielded some results which render it desirable that they should be placed before the farmers and discussed at once, in order to provide against a recurrence of avoidable injury in the future.

Amount of water required by crops.—It is not very generally understood how large an amount of water is required for the production even of fair crops; for the maximum of possible product is rarely obtained on the large scale, because it is not often that all conditions are at their best at any one time and locality. But from numerous observations, made both in Europe and in the Eastern United States, it has been found that from 300 to over 500 tons of water are on the average required to produce one ton of dry vegetable matter. In Wisconsin, King found that a two-ton crop of oat hay required over one thousand tons of water per acre, equal to about nine inches of rainfall. The average rate for field crops at large is given by European observers at 325 times the weight of dry matter produced, being at the rate of about three inches of rainfall actually evaporated through the plant.

These data should enable us to estimate the adequacy of the moisture contained in the soil at the beginning of the dry season to mature the crop, provided we make due allowance for any growth already made at the time, and provided also that the estimates as to the water-requirements derived from the experience of the countries of summer rains (the humid regions) hold good for the arid region also. Whether or not this can be assumed is among the points our experiments are designed to determine. The surprisingly successful growth and bearing especially of deciduous trees, without irrigation, despite a drought of five or six months in the "Franciscan climate," has led to an impression that a less amount of water may suffice under arid conditions. For in the East, as many weeks of drought and intense heat would frequently suffice to destroy the crop.

Probable causes of this endurance of drought.—Doubtless the main cause of this remarkable endurance is to be found in the much deeper rooting of all plants in arid climates; whereby not only a much larger bulk of moist soil is at their command, but the roots are withdrawn from the injurious effects of the hot, dry surface and air.

This deeper range of the roots is not the result of foresight on the part of the plant. It could not occur on Eastern soils, because of the intervention, in the great majority of cases, of difficultly penetrable subsoils; from which, moreover, plants could draw but little nourishment on account of their "rawness." In the arid region, as a rule, subsoils in the Eastern sense do not exist; the soil mass is practically the same for several feet, and in the prevalent soils is very readily penetrable to great depths. This, summarily speaking, is due to the slight formation of clay, and the rarity of heavy rains, in the arid region. And this easy penetrability of the soil implies, moreover, that being well aerated, the depths of the soil are not "raw," as in the East; and therefore that the "subsoil" such as it is, may fearlessly be turned up as deeply as the farmer is willing to go with the plow, without danger of injuring the next season's crop, in all lands that are well drained; as, by reason of their depth and perviousness, is the case with most California soils. * * * It is equally clear that it is to the farmer's interest to favor, to the utmost, this deep penetration of the roots, both in the preparation and tillage of the ground, and in the use of irrigation water. For if the latter is used too frequently or too abundantly, the salutary habit of deep rooting will be abandoned by the plant, and it will, as in the East, be dependent upon frequent rain or irrigation; and also, owing to the small bulk of soil upon which it can draw for its nourishment, upon frequent and abundant fertilization.

Eastern immigrants as well as a large proportion of California farmers do not realize the privilege they possess of having a triple and quadruple acreage of arable soil under their feet, over and above the area for which their deeds call; and they tenaciously continue to adhere to precautions and practices which, however salutary and necessary in the region of summer rains, do not apply to this climate. The shallow plowing so persistently practiced results in the formation of a "plowsole" that plays the part of the Eastern subsoil in preventing root penetration; limiting their range for moisture and plant food, and thus naturally causing crops to succumb to a slight stress of season which ought to have passed without injury, had the natural conditions been taken into proper consideration.

Roots follow moisture.—Very striking examples of deep rooting as the result of vertical moisture penetration can be observed in some of our native trees, which, while naturally at home on moist ground, are nevertheless sometimes found forming luxuriant clumps on the slopes and even summits of our coast ranges and foothills. If we examine the ground where this occurs in the case of California laurel, we will generally find that the soil in which they grow is underlaid by slate or shale standing on edge, into the crevices of which the roots penetrate, wedging them open; while themselves flattening out, and thus penetrating to moisture at considerable depths. The same may be observed in the case of the erect "bedrock" or foothill slates of the Sierra, on which native as well as fruit trees flourish in very shallow soils, sometimes reaching permanent moisture at the depth of ten or more feet below the surface. It can readily be observed during rains that there is comparatively little run-off from the surface of these lands underlaid by vertical shales.

On the same principle, the grape vines which bear some of the choicest raisins of Malaga on the arid coastward slopes, are made to supply themselves with moisture, without irrigation, by opening around them large, funnel-shaped pits, which remain open in winter so as to catch the rain, causing it to penetrate downward along the tap-root of the vine, in clay shale quite similar to that of the California Coast Ranges, and like this latter, almost vertically on edge. Yet on these same slopes scarcely any natural vegetation now finds a foothold.

Similarly the "ryots" of parts of India water their crops by applying to each plant immediately around the stem such scanty measure of the precious fluid as they may have taken from wells, often of considerable depth, which form their only source of water supply. Perhaps in imitation of these, an industrious farmer has practiced a similar system on the high benches of Kern River, and has successfully grown excellent fruit for years, on land that originally would grow nothing but cactus. Sub-irrigation from pipes has been applied in a similar manner.

The principle flowing from the above is simply that the most economical mode of using irrigation water is to put it "where it will do the most good," close to the stem of the plant or trunk of the tree, and let it soak downward so as to form a moist path for the roots to follow to the greatest possible death. It is this deep penetration to natural moisture, as a matter of fact, which enables the small quantities supplied to produce such marked effects.

Basin irrigation.—It will be noticed that this principle is practically the same as that of the basin irrigation of orchards, which was originally largely practiced in California, but has now been mostly abandoned for furrow irrigation. The latter has been almost universally adopted, partly because it requires a great deal less hand-labor, partly under the impression that the whole of the soil of the orchard is thus most thoroughly utilized; partly also because of the injurious effect upon trees produced at times by basin irrigation.

The explanation of such injurious effects is, essentially, that cold irrigation water depresses too much the temperature of the earth immediately around the roots, and thus hinders active vegetation to an injurious extent, sometimes so as to bring about the dropping of the fruit. This, of course, is a very serious objection, to obviate which it might be necessary to reservoir the water so as to allow it to warm before being applied to the trees. In furrow irrigation the amount of soil soaked with the water is so great that the latter is soon effectually warmed up, besides not coming in contact too intimately with the main roots of the tree; along which the water soaks very readily when applied to the trunk, thus effecting their temperature much more directly. It is for the fruit grower to determine which consideration should prevail in a given case. If the water supply be scant and warm, the most effectual use that can be made of it is to apply it immediately around the trunk of the tree, in a circular trench dug for the purpose. When, on the contrary, irrigation water is abundant and its temperature low, it will be preferable to practice furrow irrigation, or possibly even flooding. As the more complete use of the soil under the latter two methods, it must be remembered that while this is the case in a horizontal direction, yet unless irrigation is practiced rather sparingly under the furrow system, it may easily happen that the gain made horizontally is more than offset by a corresponding loss in the vertical penetration of the root-system. This is amply apparent in some of the irrigated orange groves of Southern California, where the fine roots of the trees fill the surface soils as do the roots of maize in a cornfield of the Mississippi States; so that the plow can hardly be run without turning them up and under. In these same orchards it will be observed, in digging down, that at a depth of a few feet the soil is too water-soaked to permit of the proper exercise of the root functions, and that the roots existing there are either inactive or diseased. That in such cases abundant irrigation and abundant fertilization alone can maintain an orchard in bearing condition, is a matter of course; and there can be no question that a great deal of the constant cry for the fertilization of orchards in the irrigated sections is due quite as much to the shallowness of rooting induced by over-irrigation, as to any really necessary exhaustion of the land. When the roots are induced to come to and remain at the surface, within a surface layer of eighteen to twenty inches, it naturally becomes necessary to feed these roots abundantly, both with moisture and with plant food. This has as naturally led to an over-estimate of the requirements of the trees in both respects. Had deep rooting been encouraged at first, instead of over-stimulating the growth by surface fertilization and frequent irrigation, some delay in bearing would have been amply compensated for by less of current outlay for fertilizers, and less liability to injury from frequently unavoidable delay, or from inadequacy of irrigation.

Conservation of soil moisture.—Alongside of economy in the use of irrigation water, the conservation of the moisture imparted to the soil either by rains or irrigation is most important; critically so where irrigation is unavailable.

Utilization of winter rains, and winter irrigation.—However strong is the popular demand for storage of the winter rainfall and flood waters, too many do not appreciate the importance of the storage they can command without the use of reservoirs, within their own soil mass. While there is a well-grounded objection to subjecting plowed land to the leaching action of the abundant rains in the humid region, no such objection holds in the case of lands lying within the limits of 20 to 25 inches of annual rainfall. Here the absorption of the winter rains should be favored to the utmost, for the run-off is mostly a dead loss. Fall plowing wherever the land is not naturally adequately absorbent, and is not thereby rendered liable to washing away, is a very effectual mode of utilizing the winter's moisture to the utmost, so as to bring about the junction of the season's moisture with that of the previous season, which is generally considered as being a condition precedent for crop production in dry years. The same of course holds true of winter irrigation; the frequent omission of which in presence of a plentiful water supply at that season is a prolific cause of avoidable crop failures. Moistening the ground to a considerable depth by winter irrigation is a very effective mode of promoting deep rooting, and will thus stand in lieu of later irrigations, which, being more scant, tend to keep the roots near the surface.

Knowledge of the subsoil.—It cannot be too strongly insisted upon that in our arid climates farmers should make themselves most thoroughly acquainted with their subsoil down the depth of at least four, but preferably six or eight feet. This knowledge, important enough in the East, is doubly so here, since all root functions are and must be carried on at much greater depths. It is hardly excusable that a business man calling himself a farmer should omit the most elementary precaution of examining his subsoil before planting orchard or vineyard, and should at the end of five years find his trees a dead loss in consequence of an unsuitable subsoil. Similarly, no irrigator should be ignorant of the time or amount of water it takes to wet his soil to a certain depth. We have lately seen a whole community suffering from the visible decline of the thrift of its fruit trees, which occurred despite what was considered abundant irrigation; i. e., allowing the water to run for a given length of time, deemed to be sufficient. Yet on being called in to investigate the causes of the trouble, the station staff found that the irrigation water had failed to penetrate during the alotted time to any beneficial extent, so that the trees were, in the main, suffering from lack of moisture—a fact that could have been verified by any one of the owners concerned, by simply boring or digging a hole or two. But no one had thought of doing so, and all kinds of mysterious causes were conjectured to be at work in the suffering orchards. A definite knowledge of the rapidity with which irrigation water penetrates downward and sideways in his soil should form a part of the mental equipment of every irrigator, particularly in arranging his head ditches. For in sandy lands it may easily happen that when these are too far apart, the water near the head ditch is already wasting into the country drainage at the depth of ten or twelve feet, before any has reached the end of the furrows, or has wetted the lower half adequately. Many such cases come under our observation, and such ignorance of the conditions governing one of the most important factors of success is hardly excusable in any one. Nor is the quality of the water used indifferent in this connection; for waters containing alkali will fail to penetrate the soil as quickly as would ordinary stream waters.

Preventing evaporation.—But supposing the moisture to have reached the depths of the soil, whether from rains or from irrigation, it is essential that proper means be employed for retaining it in the land, and especially to prevent evaporation. That this is best accomplished by a mulch on the surface, and that the best mulch for the purpose, which need not be hauled on or off and is always ready, is a surface layer of loose, well-tilled soil, is now pretty well understood by all. But the extent to which the presence or absence of such a non-evaporating layer influences plant growth and fruit production in a critical time, is not so fully appreciated. Plates 3 and 4 at end of Bulletin [plates omitted] give an illustrative example of trees and fruit grown this season on adjacent fields, with only a lane between, the soil and all natural conditions being absolutely identical; the only difference being the presence and absence of cultivation. In the present case the cultivation was omitted on principle by one owner, who considered cultivation superfluous on the loose, generous soil of Alameda creek; while his neighbor, across the way, held the opposite belief, and had this season cultivated to an extra depth to conserve moisture. The cultural results are sufficiently shown in the plates and need no comment, although it may be of interest to mention that the year's growth on the one hand was over three feet, on the other barely three inches. The effect on the fruit is shown in plate 4. The determination of the moisture held by the soil in July to the depth of six feet gave the following results:

Depth in Soil.	Cultivated.		Uncultivated	
	Per Cent.	Tons per Acre.	Per Cent.	Tons per Acre.
First Foot	6.4	128	4.3	86
Second Foot	5.8	116	4.4	88
Third Foot	6.4	128	3.9	78
Fourth Foot	6.5	130	5.1	102
Fifth Foot	6.7	134	3.4	68
Sixth Foot	6.0	120	4.5	90
Total for six feet	6.3	756	4.2	512

The difference of 244 tons per acre of ground shown by the analyses is quite sufficient, according to the data at the beginning of this bulletin, to account for the observed difference in the cultural result. The cause of this difference was that the uncultivated field there was a compacted surface layer several inches in thickness, which forcibly abstracted the moisture from the substrata and evaporated it from its surface; while the loose surface soil on the cultivated ground was unable to take any moisture from the denser subsoil. This is well illustrated by the familiar fact that while a dry brick will suck a wet sponge, a dry sponge (corresponding to the loose surface soil) is unable to take any water from a wet brick. Besides, the tilled surface soil forms a non-conducting layer protecting the subsoil from the sun's heat and the dryness of the air.

In the East where this principle is well understood, it is considered that a surface layer three inches in thickness is sufficient to afford effective protection. But what is adequate in the region of summer rains is quite insufficient in California and in the arid region generally. It takes fully twice the thickness mentioned, and preferably more, to afford protection against the drought and heat lasting five or six months at a stretch. Here again we find an important point in which our practice must differ from that of the East and of the Old World.

The beneficial effects of summer fallow in California are assuredly due quite as much to the conservation of moisture brought about by the tilled surface layer, as by the weathering of the soil to which the efficacy of the fallow is commonly ascribed. Witness the fact that weeds come up freely on summer-fallow as late as August, when unplowed land is as bare as a barn floor.

Similarly on our mostly new and unexhausted lands, the bad effects of weed growth are doubtless due fully as much to the waste of moisture going on through their leaves as to the competition with the crop in plant food. Hence all good orchardists are very careful about keeping their ground clean in summer; but it must not be forgotten that by doing so they quickly deplete their lands of vegetable matter, which requires systematic replacement if production is to continue normally. Yet of the two evils, the loss of moisture is more to be dreaded, and very generally in practice the more difficult to remedy.

[NOTE.—The original issue has several illustrations, showing the effect of cultivation. These we are obliged to omit. Editor PLANTERS' MONTHLY.]

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CAUSES OF SUGAR SUPERIORITY OF GERMAN SUGAR FACTORIES—FROM A FRENCH POINT OF VIEW.

By Paul Oudin.

(Specially translated for "Sugar" from "La Sucrerie Indigene et Coloniale.")

The notes which follow are the summary of observations made during a stay of many years abroad. The "sugar question" has been, since last year, very frequently brought before the public attention. The debates of the Chamber at the time of the voting in regard to export bounties showed that this question was very complicated. Recently, however, an international conference, held at Brussels, has been in quest of a "terrain d'entente" for the total suppression of these premiums, or bounties. The author hopes that these notes will serve to direct some light on the actual situation of sugar manufacture, and that, on the other hand, they will confirm on this special point, social facts already frequently pointed out.

If we examine the list of countries which produce sugar, we can gain a fairly satisfactory idea enabling us to judge both the general situation of the sugar industry in Europe, and the particular situation of this industry of Germany or France. These sugar-producing countries are, in order of importance, as follows:

1. Germany, with a principal center in the Saxony Province lying between the Elbe and the Wesser, and bounded

on the North, and on the South, by Leipzig; there are besides several secondary groups of which the centers are: Cologne, Breslau, and Frankfort-on-Oder.

2. Austria, but particularly Bohemia.

3. Russia, with two groups; that of Varsovia and that of Keiff-Charkoff.

4. France, principally in the northwest region.

5. Belgium, Switzerland, Sweden, Denmark and Spain.

Mention must be made also, as a matter of completeness, of those regions where sugar is of a more recent introduction, such as Mecklenburg, East Prussia, Pomerania, Hungary, etc. The increasing influence of these centres generally removes the center of gravity of production. Besides, then there are certain regions wherein the sugar industry is still an uncertain prospect as is the case north of Italy, and in Roumania, etc.

This list shows what extent of ground is occupied in Europe for the cultivation of beets and demonstrates how well this plant grows, under the condition that a variety of seed suited to the different local situations of climate and soil is selected and planted.

We see an explanation for this necessity for seed selection in the constitution of the plant itself. The beet seed, which is only the size of a millet seed, is enclosed in a hard and thick skin. A persistent humidity only can penetrate the hard skin, and the germ finding insufficient food in the seed before the roots are formed, requires that the earth-layer which covers it should not be too thick and close, but, on the contrary, accurately calculated, and at the same time not too tightly packed down. This permits both heat and air to penetrate through the interstices of the soil to the seed.

But as soon as germination is effected, and the roots are formed, the beet becomes an exceedingly robust plant, resisting vigorously and generally successfully both soil and season difficulties. When it is provided with roots and leaves, it has passed the most difficult phase of its vegetation. New cares, however, arise and must be paid to it directly for its cultivation to become remunerative. A first weeding, pricking out, or "demariage" places the beets at a designed interval between them to enable it possible to obtain the best development of each plant. Subsequently weeding must be strenuously resorted to by the excellent "cultivators" now made in order to take out the weeds, and permit the access of heat in the soil. And not least, it is necessary at different epochs, to spread on the ground good, suitable manures in considerable quantities. It is this latter, principally, that has contributed so considerably to the progress of the cultivation of beets during the past fifty years. When cropped, the returns handsomely compensate the agriculturist for the care and expense he has incurred. According to Deherain, of all plants of high culture, beet root derives more profit from these frequent manurings, but it leaves some part of it for the benefit of the subsequent crops. Despite these advantages and profits, however, the special preparation of the ground before sowing, the repeated "diggings" or "cultivations" at different phases of the growth, both require considerable labor, the necessary knowledge of the conditions of soil and climate are to the hand of everybody, that is, at first; besides, the use of manure and erection and equipment of factories to transform beets into sugar, require considerable capital.

All the necessary conditions of suitability and richness of the soil and the climate were marvelously realized in most of the regions enumerated above, which have been the cradles of sugar industry in Europe. The middle region of the Elbe district, known under the name of the "Magdeburger Borde," has long been celebrated for the richness of its soil, and this was also the case in the "Soissonnais," in France, and certain regions of the Department of the Nord. The facility and freedom in the exchange of goods, together with easier connections for intertrading, have brought here, in addition to comfort and well-being, more intense intellectual culture. These circumstances are necessary for the introduction of a new industry. The germination and guiding to fruition of this industry has had its pioneers and even its "victims," such as Crespel-Delise, in France. In his last years this initiator or promoter was reduced to live on a modest national subscription, after having struggled all his life, and even acquired at one period in this new undertaking a considerable fortune.

One of the causes of the success of beet sugar manufacture is the inferiority in some respects of sugar-cane. Sugar-cane grows only in warm and damp climates, and, in consequence, its ground of expansion is rather limited. Certain favorable factors, such as richness in sugar, would seem at first sight to give it important advantages; but except at Java, where it is in the hands of Dutchmen, the sugar-cane industry, directed and worked from its initiation by races of the community more or less disorganized, not very energetic, and more inclined for the dolce far niente than for the hard and long-continued struggle of commercial life, could not sustain itself in the high position which its competitor now occupies. Notwithstanding the tense of competition, the crude processes of a preceding age have remained long in use, and in the last few years this industry has undergone a set-back, owing to these and other causes, and this is further accentuated by the precarious situation at this present moment. Whilst in 1887-8 the part played by cane-sugar in the sugar production of the world was still as high as 51.4 per cent., in 1896-7 it was not more than 33.8 per cent. If we compare the statistics of the universal production of sugar in 1871-2 and 1893-4, we see that this production has increased by 165 per cent.; in this augmentation, sugar-cane has increased by 98 per cent. and beet-root sugar by 252 per cent., which means that the progress of beet sugar has been, in this period of 20 years, two or three times greater than that of cane sugar.

To complete the enumeration of the different conditions of ground favorable to the cultivation of beets and the manufacture of sugar, I must point out that the abundance of the fuel plays an important part.

The regions mentioned at the commencement of this article are not very far distant from either coalfields or lignite deposits, such as, for instance, the coal mines of the North of France, those of Bohemia, the Donetz basin, and the lignite layers of the Province of Saxony, etc.

Sugar manufacture, perhaps more than any other industry, requires combustibles. It requires in its effect, not only to produce steam to put in motion the necessary machinery, but also to evaporate the juices. Here some technical details are necessary. After the rooting up, beets are first of all cleaned in "laveurs" or "washers," and afterwards cut in small and thin laminated pieces or slices called "cossettes." These cossettes fall in a series of vertical reservoirs, containing from 20 to 60 hectolitres, called "diffusers." There, a flow of hot water automatically washes these cossettes, carrying away sugar and soluble matter and leaves as residue the "pulp" of the beet utilized in feeding cattle. The juice of beet thus obtained is very impure. It is first purified by means of the action of lime combined with that of carbonic acid. These two operations are called "chaulage" and "earbonization." This treatment is generally carried out twice and the process is then completed in certain factories by means of bleaching with sulphurous acid. After each operation there follows a filtration process in filter-presses, in which the juice leaves its impurities together with the precipitated carbonate of lime. The residue formed is called scum (ecume). The clear juice is purified and at last evaporated in order that its crystals of sugar may be separated out.

It is this last treatment of evaporation successfully effected in the complex elements of compound evaporators, which absorbs a quantity of combustibles at least equal to that absorbed in furnishing motion to the machines.

In a factory working 300 tons of beets in 24 hours, the consumption of steam in a day is about 585 kilogrammes per ton of treated roots, for furnishing power to motive engines and machinery, while 870 kilogrammes per ton is utilized for heating and evaporating the juice. The waste of heat by radiation and otherwise consumes about as much, so that the total quantity of corresponding waste of coal is about equal to 130 to 150 kilogrammes per ton of beets. Thus we get the important quantity of 4,000 tons of coal, and an expense of about 80,000 francs in the treatment during the campaign, of 30,000 tons of beets. In well fitted factories the consumption of coal might be reduced to less than 100 kilogrammes per ton of beets.

All this explains the great importance, even when means of transport were not very extended, of sugar manufactories being placed in close proximity to coal fields. It is necessary, too, to briefly mention, the advantages arising from the presence, in these regions, of limestone, which furnishes the carbonic acid necessary for purification. Though its factor may not be as important as coal, we are compelled, when there is none of it in the district, to have recourse to some more complicated and consequently more expensive process of purifying.

If, helped by these general remarks, we try to compare the situation of the French factories with that of the German, we are first of all struck by the enormous development that has taken place in the latter during the last twenty years.

Between 1872 and 1894, France has hardly doubled its sugar production, while Germany has increased sevenfold; as to exports which, in the same period, have not increased in France, they have increased in Germany about 23 times.

In 1884, the syndical chamber struck by this situation, appointed, at the request of M. Seblime, a commission charged with a duty of investigating the causes which led to this expansion. His report described the situation in these terms:

"In 1871-72, France held the first rank amongst the European sugar countries, with a production of 387,444 tons of refined sugar corresponding to 319,382 tons raw sugar; Austria, the second, with a production of 213,000 tons gross; Germany, the third, with a production of 186,442 tons, and Russia, the fourth, with a production of 170,000 tons; then followed Belgium and Holland. In 1873-4 Denmark and Sweden started the manufacture of sugar.

"In 1877-78, France still held the first place, with a production of 341,256 tons of refined sugar or 379,174 of raw sugar; but Germany came next with a production in gross nearly equal to that of France, 378,009 tons. Austria took the third place, with 346,000 tons, and Russia kept the fourth place with 292,000 tons. The production of Belgium and Holland has remained stationary; Denmark and Sweden are not out yet of their trial period.

"In 1878-79, France lost her rank; she took the second place with 412,034 tons of raw sugar; Germany having the first with 426,115 tons; Austria remained in the third, with 380,000 tons, and Russia in the fourth with 273,000 tons.

From this time we see the production of Germany increasing each and every year; that of Austria also increasing, but in a much more moderate way; whilst that of France is extremely irregular. It fell in 1879-80 to 238,210 tons of refined sugar, then rose progressively to 406,007 tons in 1883-84; that of Russia rising slowly, but continuously, and this country alternately gets the third and fourth places with France.

Belgium and Holland still keep the old position, and Denmark and Sweden are gradually emerging from their trial period.

At last, in 1893-4, we find European sugar countries classified in the following way:—

Raw Sugar produced in 1893-94. Countries	Tons	In Comparison with 1871-72.
1. Germany	1,382,591	7½ times greater
2. Austria	832,089	3.90 times greater
3. Russia	650,000	3.80 times greater
4. France	542,097	1.69 times greater
5. Belgium	188,327	2.00 times greater
6. Holland	72,000	1.26 times greater
7. Sweden	36,000	
8. Denmark	24,000	

This equals a European production of 3,727,107 in 1893-4. Against 1,001,824 in 1871-72, or 3.72 times greater; that is, an augmentation of 272 per cent.

Thus, not only has the progress of France been very inferior to that of Germany, but it is equally inferior to the average augmentation of the production of Europe.

If we consider export, which represents the surplus of production on consumption, we note that in spite of the increase of the latter, an increase valued at about 9 per cent. for the whole world, European exports have followed a rapidly ascendant course.

Exportation (Average per Year.)

	Period.	Period.	Augmentation in 1891-4 as Compared with 1873-6.
France	307,566	271,312	....
Germany	27,406	715,141	26 to 30 times
Austria	82,384	452,531	5 to 6 times
Belgium	79,223	157,132	2 to 0 times

In consequence of the inherent difficulties inseparable from the collation of general statistics, these figures are probably not absolutely correct, but they show, nevertheless, the general progress of the export of the leading European sugar countries, and the advantage gained by Germany is very considerable.

The causes generally assigned to this huge expansion are generally three: the war of 1870, the low wages paid to workmen, the low costs of transportation and coal, and finally the effect of legislative enactments. It is, however, necessary to examine these attentively, to determine whether these reasons do not rather hide other causes, and perhaps more interesting ones.

As regards the effects of the war of 1870, it is not to be doubted that its result has brought to Germany an expansion of commercial strength which was lying dormant for a long period; trade exchanges have been facilitated in the country itself, whilst in regard to those countries outside its boundaries remote markets have found in the military successes of the nation a powerful moral protection. But this cause by itself cannot explain such an advance in position.

The low price of coal has had also its influence. The coal measures and lignitate layers in Germany are generally not very deep and are easy to work, and, in addition, miners are paid low wages; but, on the other hand, the mining appliances and the technical staff are seldom better than those of France. Notwithstanding the low cost of coal, various powerful syndicates have combined to maintain the price above its normal value, with the effect that several sugar factories have been driven to importing English coals, the cost of which is less than that of the artificially-inflated native fuel. Lignite is certainly cheaper than coal, but, on the other hand, its quality is greatly inferior. The cheapness of fuel has an indisputable influence, however. It is difficult to fix a total amount corresponding to the saving on this head on the production of the country, but it will not be extravagant to assume that from the cheapness of fuel alone there results a saving in cost price of at least 40 or 50 centimes per cwt. of sugar in favor of Germany as compared with France.

The allegation of the effect of low cost of transport, is, however, more disputable. Freights are higher in Germany than they are in France, thanks, fortunately, to the competition for freights which exists in France. So that although Germany exports more than two-thirds of its total production, the alleged saving in cheap freights cannot have, on the whole, any very considerable importance.

Labor, at least, in the rural districts, is rather cheaper in Germany than in France. The whole country is in its entirety poorer, and its soil less fertile than that of France, and therefore the workers in Germany lead a more simple life owing to this national poverty. If the soil of Saxony, especially, and that of the valleys of the Saale, and of its confluents, is acknowledged to be of remarkable fertility, it does not follow that the conditions of life in these selected regions govern those of the whole of the remainder of the country. In the working class families in Germany, the breeding of pigs, and the cultivation of potatoes furnish a considerable source of income, and one that does not demand very onerous conditions. Thus, according to M. Blondel, "the journeymen of the province of Saxony receive 1.25 marks to 1.75 marks daily, and at the time of harvest, about 2 marks; women's wages rarely exceed 1 mark per day. The yearly pay of workmen employed for the whole year is only 180 marks, and in certain villages this falls even to 70 or 80 marks." On the whole the wages paid to workmen are on the average 20 per cent. lower than those paid in France.

The less-favored regions of Thuringia, Silesia, and Poland furnish still cheaper labor. From April, a crowd of Poles or "Sachsengaenger" invades the province of Saxony. Numerous youths find work, often even before passing school age, in the agricultural works inseparable from the labor which beets require in cultivating. In towns, on the contrary, workmen's wages seldom reach the amount paid to French workmen. But, if one desires to appreciate the effects of low wages in the sugar industry, it is important that a precise distinction should be made between the two phases of labor necessary in the production of sugar; namely, that of the agricultural laborer and that of the town workman employed at the factory. On the whole, it is obvious that the raw material or beets are produced in Germany at a lower cost than in France. The before-mentioned report of the Syndical Chamber holds that whilst beet-root is paid for in France, at the rate of 26 francs per ton, in Germany only 25 francs is paid. But from this price of 25 francs, paid in Germany, a deduction has to be made for the cost of transportation, management, and preservation, which are sustained by the cultivator in Germany, while in France these charges are defrayed by the sugar manufacturer. These expenses are about 2 francs 25 cents per ton; the German agriculturist is, therefore, satisfied with a net return of 23 francs per ton instead of the 26 francs paid to the French farmer. This works out, in a crop equal to 30 tons per hectare, to a sum of almost 100 francs less than that secured by the French grower. Labor is not the sole cause of this difference, for if labor is secured at a low figure, yet the soil charges are on the contrary very high. In consequence of competition, and of the constant demand for agricultural land, the land charges amount to nearly three or four times as great as those ruling in France; even in the case of rented lands it follows that rent charges are proportionately higher in Germany than in France.

In the factory a similar state of compensation for town labor charges does not occur; no cause diminishes the effect of the lower rate of wages paid. The processes of working are but little different to those existing in France, and the factories employ in Germany practically the same number of workmen to that customary in France. There is then, owing to this acknowledged fact, a notable advantage for the German producers, an advantage which can be valued at 70 centimes per cwt. of sugar. The difference arising from this, as well as that made up by the lower price of fuel, is very small, and in no way accounts for the total reduction in the cost of manufacture in Germany, which may be said to be six or seven francs per quintal less than that ascertained in French practice.

We reach the conclusion then that it is neither the cheapness of labor nor that of fuel that is the most important cause of the superior advance of German factories, as compared with those of France, and that other causes must be credited with bringing about this result.

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SOME PHASES OF THE SUGAR INDUSTRY.

(A letter addressed to the Mackay Sugar Journal.)

As we are on the eve of a record crushing season and resulting bedrock prices, would it not be advisable to emphasize some phases connected with the sugar industry? As a preface to what follows I beg to state that most of the opinions herein stated do not originate with the writer, nor do I wish to pose as an authority, but merely to record certain methods in vogue in some of the best mills and which have been proved effective. So to those "who know all about it" these remarks do not apply, but if, on the other hand, they help in places; and at times, when the light of experience may be dim, then the object for which this is written will have been attained.

Briefly put, the industry is between "the devil (of a labor problem) and the deep sea" of a commercial monopoly. In the first place the people are opposed to the introduction of any more colored labor for sugar production, and on the second count, the prices of raw sugars have been reduced lower than what would be the natural price if we had a little more competition in refining. Many people lay the blame of low prices for cane and the consequent necessity for cheap colored labor on the mill owners, but they ignore the fact that the majority of mill owners employ white labor in the mills, and although it costs more to manufacture raws than to refine them, the manufacturer's "wage of industry" or profit is ridiculously small in comparison to the refiner's. During the coming season the grower will receive about £5 10s. on every ton of refined sugar produced, the manufacturer £8 10s., and the refiner £14 to £15. Now as the first two parties in this deal do 75 per cent. of the labor necessary to produce this article, this is a splendid illustration of what control of an industry can accomplish even under a democratic (?) form of government; and although in some instances private mill owners have a tendency to "exploit" their cane suppliers and employes, yet every praise is due for carrying on, and extending operations in the face of persistent drops in sugar values, and they deserve political consideration quite as much as the cane growers. So if our politicians will assist the growers and manufacturers to secure part of the huge sum now paid to the refiners, they will not only command the gratitude of the community but their policy would go a long way towards solving the vexed question of colored versus white labor, for after all it is merely a matter of £ s. d.; and it needs but little thought to see that the limit contained in this is within the sphere of practical politics. However, this would take time, and as there are still avenues for improvement about to be adopted in some mills, I trust you will allow me to proceed with this subject, notwithstanding that some of the preceding expressions may be contrary to your own and readers' views.

The direction in which improvements may be almost immediately effected, lies in the sugar boiling problems that you have ventilated of late. In some mills the impression seems to be that whereas the "firsts" comprise the biggest part of a crop, and because the existing methods of crystallizing this class are simple—therefore the crystallization of the balance does not require much attention, and may be scrambled through anyhow. But by every process of reasoning this seems a mistake, for precisely at this stage of manufacture is the spot where a great part of the loss, shown in final molasses, occurs. In some mills whose milling power may be in excess of their capacity for cleaning and evaporation, the juice is also "rushed" through without proper attention to details of manufacture, and the consequences are, difficulty in granulating the lower grades, large quantity of final molasses containing unusually high percentage of sugar, and the average net litre of the whole crop lewered considerably. Although a plant should be always and continuously worked up to its full capacity for good work, yet its effective strength should not be exceeded, otherwise the results will be less profitable. Special care should be given to the elimination of impurities in the juices by strictly adhering to the best known methods of clarification, subsiding and filtration. This is more necessary for raws than whites. Liquor is used for "washing" at the frugals because it does not melt so much sugar as water would, and the quantities of "ash" in the analyses are reduced to a minimum. The crystallization of "seconds" should never be hurried beyond its normal point, for there seems to be a fixed ratio between the time necessary for complete solution operated on, and also because "rushed" seconds always lose in both color and quantity. Wherever the pan power is insufficient to effectively work this class it has been found advisable to boil flat, dry roughly, and melt up with the juice prior to clarifying or wherever most convenient. Of course this plan is only necessary when the viscidity of the syrup is abnormal, and the pan power defective, but under ordinary conditions second crystallization may be conducted without the addition of either first masse-cuite or liquor. In any case the benefits derivable from mixing these grades while boiling is a moot point. Remelting is as a rule preferable to "seeding" because the process does not foul the coils, and the resulting sugars are purer than a strike made by the "seeding" process. As raw sugars are paid for according to strength or purity, it follows that it would be better to make say—100 tons worth £1,000 than 150 tons whose value is the same,—provided the extra cost of producing the higher grade does not exceed the amount saved in freight, etc., on the difference in quantities.

Another point worth discussing is, any suggestion for improvement of the vacuum pan in general use, which is becoming obsolete. The circulation of the masse-cuite is defective. The arrangement of the coils hinders the discharge of masse-cuite. And the methods of "boiling" or "cooking" in a single pot might be improved upon (say) by applying the principle of the triple effect—namely, separate compartments or pots to receive the masse cuite at different periods of its growth. Then if the principle of crystallization in movement could be applied to the masse-cuite as a final process before it leaves the vacuum apparatus, I imagine a great improvement would be the result, because this crystallization in movement is simply the sequel to the final parts of our present methods of sugar boiling, known amongst sugar boilers as "drying up," and if we had a cylindrical vacuum apparatus fitted with a spiral revolving steam coil like those formerly used in the old Wetzel pans, or supplied with revolving steam chambers attached to a hollow shaft, and made in such a manner that they would have a screw action—then the masse-cuite could be drawn by gravitation into this affair before "drying up," and there the sugar boiling process could be continued until only about 3 per cent. of water remained. By these means I opine it would be possible to extract as much sugar with two boilings as we now do with four.

Now in conclusion I would like it to be understood that my intention was not to butter up one section of the community and run down another, but to record hard facts connected with the subjects under notice. Therefore, although the mill owners are somewhat commended herein, it is equally imperative to criticise certain defects in the general character of some of our cane growers. Although there are many hard working plodding farmers amongst our cane growers, there are others whose example is injurious and from whom much was expected. I refer to the would-be planters who evidently started with the idea that successful sugar growing was only a matter of a year or two's hard work, and then—heigh ho! Melbourne cup holidays, European trips galore, and a general round of good times ever afterwards. These anticipations not being realized, they seem to care little whether their produce is rich in sugar or not, and are perfectly indifferent even as to the manner of harvesting their crop so long as they can pass quantity, irrespective of quality, over the weigh bridge. Amongst farmers (?) who are growing cane for a "private" mill this is intelligible, but for those who are "interested" in a central mill to be guilty of such lunacy passes one's comprehension. When the cane-grower improves his cane to the same extent that the miller has improved his mill, the better chance the former will have of averting extinction, for our economic systems respect only those who successfully negotiate the law relating to the "survival of the fittest." Of course, stiff rents in some cases, and dear labor, are vexatious taxes on the industry of our cane-growers; but perhaps a little political pressure judiciously applied would soften the "stiffness" and help to reduce the appearance of the other trouble.

Although "plant selection" is adopted by a small section, yet there are numbers who persist in disregarding the voice of science on this head by planting from inferior cane, and then blame the climate, or the soil, or those who work the mill for the poor returns obtained from such cane. Another point repeatedly driven home of late is the urgent need of carefully topping the cane in the field. Every foot of unripe cane sent to the mill contains enough glucose and melassigenic matter to render unobtainable the sugar in another foot of ripe cane. Or to put it arithmetically—100 tons of ripe cane properly topped would return 12½ tons of sugar. But 100 tons of cane containing 10 per cent. of unripe stuff would be: 100 tons less 10 per cent. unripe plus 10 per cent. rendered unripe by the former's presence, i. e., 80 tons of cane giving 10 tons of sugar. Or in other words the cane mentioned in the first illustration is worth four shillings per ton more than that mentioned in the second instance. Or put it in this way: A farmer delivers 100 tons badly topped cane for which he receives say £50. Another man cuts an equal area for 80 tons and receives £56. Problem—does it pay to cut, handle and cart 20 per cent. more stuff for £6 less? ! ! It is only the stroke of the knife that makes the difference, and hoping that this "stroke" will be nearer the roots than hitherto,—I am, Sir. Yours, etc.,

C. G. MUNRO.

AMERICAN SUGAR PRODUCERS.

EDITOR OF THE SUGAR PLANTER'S JOURNAL, LA.:

Sugar producers in the United States are naturally anxious as to the future of the sugar producing industry in this country, and nearly all writers for the press who touch upon the subject of home production of sugar are taking rather gloomy views of the future in this regard, since this nation has annexed the Hawaiian Islands and laid hands on Cuba, Porto Rico and the Philippines; yet with all this there is no reason to despair or throw up the sponge, so to speak, there is no likelihood that any competition now in sight from the countries named will destroy the sugar industries of the United States; on the contrary, the capital, energy, skill and capacity that have established home production of sugar among leading American industries, will continue to prosper and increase as other industries have done, and will continue to do, under this progressive government.

In my opinion, more is to be feared, if there be any fear, from Hawaii than from any other source in the Pacific; yet for twenty-three years of the treaty with Hawaii, producers have prospered and largely increased home production of sugar. True the Philippines have great normal capacity for producing sugar, but it will take many years, much capital and skilled labor to develop the sugar industry much beyond present production. As to Porto Rico, the island is more likely to increase the production of coffee, for which it is peculiarly adapted, than to push sugar production to any great extent, and it is by no means certain that Cuba will be an American colony for years, if ever, but in this world there is more sunshine than storm, and while our home industry, as regards sugar, is not in imminent danger, our commerce and trade with the countries above named must increase.

Porto Rico will, under American rule, send us large quantities of coffee and tropical fruits that we cannot produce, and while these products will enter free of duty there will be so much less gold to send to other countries for such articles. The natives of the countries, who are now poor and half clad, will under an American system be well paid and want a hundred articles to one, now used by them, of our food products as well as clothing and other necessaries of life. All the countries named must have vast quantities of machinery for railroads and manufacturing purposes, agricultural implements, shipping coal, lumber, woodenware, engines, rolling stock, petroleum oil, furniture, clothing goods and numerous other articles of which but a moiety are now consumed in the countries or late colonies of Spain. Cuba must pay duty on such imports and Cuban sugars must continue to be dutiable when imported to this country, at least for years.

Under American rule in Porto Rico and the Philippines, consumption of every description of American industrial productions will rapidly increase, prices of labor in the new possessions as well as in Cuba will increase pro rata, and the cost of producing sugar will be doubled in the Philippines while a better sugar will be made. The raw sugar now produced in the Philippines is the crudest and dirtiest imported by this country, and with the exception of Indian Jaggery that is imported by England alone, as a rule, it is the poorest sugar used in refineries in this country or Europe, and has little or nothing to do with fixing the home market value of sugar produced in the United States. If the Philippines become a United States colony, higher grade sugar will be made at double the present cost which, with cost of freight, insurance, handling, shrinkage and time required to import it, will place it nearly or quite on a par with the cost of producing sugar in this country, leaving little to disturb prices of the home production.

American enterprise is quite competent to compete with any condition likely to arise as a result of an increase of sugar producing territory taken from Spain; in fact, our cane and beet sugar producers have three sources of apprehension more important to consider: first, the new territory of Hawaii will prove a powerful competitor by reason of its enormous capacity of sugar production per acre. Although cane requires about eighteen months to fully mature and is of enormous growth, the yield of sugar per acre ranges from about six or seven to nearly twelve tons of sugar per acre, as stated by the Hawaiian Planters' Monthly of recent date, and a fact well known and of common report. Nothing comparable to such yield has ever been known in other sugar producing countries, and it is certain that the present production of sugar in Hawaii can and will be greatly increased in acreage.

Second, home sugar producers must compete with the beet sugars of Europe. The tariff discrimination against the export bounty system of Europe, will prove but a temporary barrier, and in fact the importation of granulated beet sugar is again on the increase and undersells American refined granulated sugar in our market. Even if the export bounty on sugar be abolished in the beet sugar countries of Europe, new methods will be adopted by those governments that will equally encourage exports. The life of the beet sugar industry in Europe is at stake, and, as stated in a report to the British Parliament, "the gist of the matter is that the majority of the people and legislatures think that the benefits which, in their opinion, accrue to the agricultural, industrial and shipping interests of the country, by the development of the sugar industry, more than counter-balance any injury from the bounties granted." The form of bounty may be changed, but the substance will remain.

Third, the war-like competition between the "sugar trust" and the Arbuckle combination, and the forces likely to be pitted against each other are not so unequal as may appear to outsiders. Prices will inevitably be cut to a minimum of profit or no profit at all, consumers will be benefitted, but home producers of sugar will have to meet the market nolens volens. The enormous consumption of sugar in the United States, approximating 14,000,000 pounds per day, about 45,000 barrels, aside from domestic sugars, has created a gigantic sugar refining business that has been virtually controlled by the Sugar Trust or American Sugar Refining Company, and the large dividend of 12 per cent. on its corporate capital has been a bonanza that other capital has long desired to share, hence it is claimed that the Arbuckle combination has $100,-000,000 of capital at its back, if so, the war will no longer be limited to a tussle for the coffee and sugar package market, but will be for the survival of the strongest, and in this view it seems to me that American sugar producers must accept low prices for sugar as inevitable for a time at least.

The most important point in the whole matter of home sugar production, is, in my opinion, first, to reduce the cost of production by every possible means, not only by the employment of the best machinery and methods and the most skillful appliances, but by practicing greater economy in every department of manufacture; in handling, in marketing and in current expenses. In these matters much can still be learned of foreign beet sugar producers and in some of the English sugar producing colonies; second, insist on continued tariff protection by Congress against foreign competition, and if possible obtain legislation that will tax Hawaiian and other sugars of other sugar producing territories that we take, sufficiently to place such sugars when landed in the United States on an equitable or parity of value with the cost of cane and beet sugars produced in this country, such tax to be employed in supporting the governments in our new possessions and collectable therein only.

HENRY A. BROWN.

West Port, Mass.

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NEW PROCESS FOR RAPIDLY REFINING SUGAR IN THE FACTORY.

(From the Sucrerie Indigene.)

We have been present at an experiment which marks an advance towards the resolution of the problem of the transformation of granulated or No. 3 factory sugar into lump sugar ready for consumption.

The inventor of this process is Mr. Robin Langlois, formerly a refiner, and his studies have resulted in this method of rapid manufacture of sugar in lumps. Starting from the principle, that almost all manufacturers of sugar now produce four-fifths of their output in fine and very pure white sugars, which may be said to require no further refining, he conceived the idea that it was now only necessary to invent an apparatus which would give these sugars the external appearance to which the consumers are accustomed, and after many trials and tentative efforts, he has succeeded in obtaining the desired result. This is arrived at by crushing the grains, which are usually somewhat large, so as to reduce them to the size of fine semolina, this semolina is heated and stirred at 45° C., for fine grain, and at 60° to 70° C. for very coarse grain, with a very small quantity of water sufficient to form a pasty mass, viz., about 2 per cent. This pasty mass is then pressed into forms, where it is cooled somewhat suddenly by passing through it, by means of a suction pump, and for ten minutes, a continuous current of air. The bars formed are then stoved at a low temperature, 30° to 40° C., in order to complete the crystallization of the very small quantity of syrup formed, and to remove every trace of moisture. This final operation, which is the longest, requires about eighteen hours. The bars thus obtained only need to be broken in the machine, and made up in packets, to be ready for the retailer and consumer.

[It will be interesting to follow the result of this process on a practical manufacturing scale, an opportunity for which will be supplied by the aparatus now being constructed by the Fives-Lille Co., which is to be set up in the Abbeville factory.—Editor *Sugar Cane.*]

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AMERICA AS A MANUFACTURING COUNTRY.

A higher compliment could hardly be paid to any nation than the following extract taken from the London "Consular Journal and Greater Britain" of April, 1898:

"The United States has already taken the place alloted to it when first the Pilgrim Fathers sowed the seed of a nation in the New World, and the country stands to-day as one of the greatest manufacturing centers of the world. Although it still remains, and will always continue to be, a principal granary for the world's food supply, the United States, with a rapidity that can not fail to excite our admiration, has raised itself from a mere grain-growing country to the more advanced condition of a home manufacturing industry, and is now working side by side with ancient countries in turning out manufactured goods which a refined civilization demands from the hand of man. * * * This marvelous growth is to be attributed to several causes, the first of which is the restless energy and strong inventive genius of the American people. These two predominating qualities have been an enormous power in the hands of the citizens of the great Atlantic Republic, and they have known how to turn it to the best advantage. But these two qualities which we have just now mentioned could not have asserted themselves so dominantly all over the world, had it not been for the wise support which the State authorities have always given to the enterprising efforts of her children, by whose intelligent labor she has become great. The recent determination of Congress to issue daily consular trade reports is direct evidence that the Government of the United States is ready to assist in every possible way the merchants and manufacturers of the country to extend their trade. We are hoping that a similar step may soon be taken by the British Government in the interests of our merchants and manufacturers. It is a concession which the Consular Journal has been foremost in urging upon the Government, and we look forward confidently to its near accomplishment. No great manufacturing country in the world can afford to neglect any measures which will promote its trade abroad, and what other nations are doing we must necessarily do. Consuls are more than ever now the outposts of a country's trade, and they must, therefore, not only be well posted, but also have an unbroken chain of communication with their base."

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INSECT PESTS IN HAWAII AND ELSEWHERE.

Mr. E. E. Green writes that, since his visit to Ceylon, Mr. Albert Koebele has been busily employed in importing beneficial insects from all parts of the world for the benefit of the Hawaiian planters. He has even gone further, and pressed into his service bats and toads, which were previously unknown in the islands. The latter seem to have been successfully established, but the imported bats are said to have disappeared. Mr. Green proceeds:—I wonder that Mr. Koebele has not tried moles. I have often thought that these little animals would be of great use in reducing the number of underground insects, such as cockchafer grubs, wireworms, cutworms, and even white-ants. Their introduction would be unattended by any danger. Even in England the only harm they can be said to do is that they spoil the neat appearance of the grass sward by the numerous little hillocks of earth thrown up during their subterranean wanderings in search of the grubs that feed upon the grassroots. It is said that the wholesale destruction of moles in England has led to a serious increase in damage from underground larvae. Mr. Koebele himself quotes an instance of the value of the mole. He tells us that a gentleman of Yokohama, "in building a lawn for a cricket ground, had a brick wall surrounding this to a depth of several feet to prevent the moles from injuring the lawn. All went well for a few months, at the end of which the grass began to get yellow and die off. All efforts with manure and water were useless, and he continuously found larvae of Scarabaeids (Cockchafers) that had come to the surface to die. Nothing could be found to remedy the evil until the gentleman was advised to take down the wall and give the moles to the larvae, which was done, and the lawn soon recovered."

Mr. Koebele may be called the "Apostle of Natural Remedies." He altogether refuses to recommend artificial remedies, as being effective only for a short time and too expensive.

In view of the failure that so frequently attends the freezing process, it would be interesting to learn what plan Mr. Koebele has found most successful for the transportation of the numerous consignments of lady-birds and other beneficial insects he has been procuring for the last three or four years.—Madras Planting Opinion.

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A GLUT OF COFFEE.

It was generally supposed ten years ago that the unconditional manumission of slave laborers in the Republic of the United States of Brazil would inflict a crushing blow on the local coffee industry from which it would be slow to recover; and it was naturally concluded that as the "visible supply" of coffee would fall off greatly, the price of coffee all the world over would advance to an unprecedented level, to the great advantage of planters in India, Ceylon, and elsewhere. And for a time these anticipations were verified. The want of labor on the coffee estates in Brazil was serious; the quantity of coffee that was placed on the market fell off greatly; and prices rose by leaps and bounds. From 1879 to 1888 prices had been much depressed, and what with the ravages of the borer and leaf disease, many planters in India and Ceylon grew weary of the hopeless struggle against misfortune, and either retired altogether from the scene, or uprooted their coffee bushes and placed their land under tea. But in 1889 prices began to mend, and in 1891, 1892, and 1893 they ranged at about 40 per cent. higher than the average between 1882 and 1886, and 25 per cent. higher than the average between 1887 and 1889. This upward movement accounts to a great extent for the recovery of the productive energy of Brazil being more rapid than was expected. The planters, feeling that they could place no reliance on free negro labor, offered the requisite inducement to immigrants from congested labor centers in Italy, and thus rapidly substituted efficient white labor for the unsatisfactory labor of emancipated slaves. With the improvement in the character and capabilities of the labor employed there was an improvement also in methods of cultivation, and estates became more fruitful. High prices in Europe stimulated the extension of planting, large estates became larger, and new estates were opened out on land previously employed in the raising of maize, beans, cassava-root, and other food staples. The effect on the shipments of coffee soon became manifest, and in the last three years it has been startling.—Planting Opinion.

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THE STRUGGLE OF COMPETITION.

In an admirable article with the above heading, the editor of the Madras "Planting Opinion" gives expression to some forcible sentiments on the drawbacks which planters have to contend with in disposing of their produce in foreign markets, and the necessity of curtailing expenses in the production of their crops. The article, as it appears, in the above periodical, applies to coffee and tea, and we omit such portions as refer to tea—those relating to coffee being equally applicable to the sugar industry.

"Planters throughout Southern India are feeling the strain of competition with other producing centres. They are anxious regarding the future. Over-production is talked of. The currency problem has to be considered. Exhaustion of the soil is a matter that cannot be overlooked. Coffee suffers as well as tea, though not precisely in the same way. Yet, through all the despondent thoughts that will come, the South Indian planters continue to work, persistently if not very hopefully. The question naturally suggests itself, are they working in the right way? It would be absurd to suppose that this question has not been fully considered by planters themselves. Yet glancing over recent reports of proceedings of District Associations, we find something wanting. The fact that new markets have dropped out of the field of discussion, has been commented upon in a previous issue. Still more noticeable, however, is the entire absence of reference to the question of cost of production. Now it seems to us that the planter, as a producer of a certain commodity for sale, when he finds competition strong and prices becoming unprofitable, should consider (1) whether he can lessen the cost of production, (2) whether he can improve the quality so as to command a higher price, (3) whether he can increase the quantity without extra outlay, and (4) whether he can find some new market that will pay him better prices than he is obtaining in those wherein he has been selling formerly. In other words, there are really two main points for consideration: (1) the cost of the commodity to him; (2) the price he can get for it. In the difference between these lies his profit.

"It is not our desire to more than touch upon the first point, in the hope that planters may give it earnest consideration. It is a subject that has many branches. Cost of coffee, for instance, includes calculations of capital outlay, interest, estate charges, curing, railage, freight, &c., for the cost we allude to is not the cost on the estate, but the cost delivered in the chief markets of the world. For convenience, we may take London as representing these. Step by step the planter who wishes to meet competition, which makes itself felt by him in the form of reduced prices, must study how little capital he can do with, what are the most economical methods of raising, curing and delivering his crops. In practically every instance, the capital was fixed long ago; but the question how to supplement that capital is often only too pressing. The use of artificial manures, again, must be considered. The cost of delivering these on the estate, the cost of labor and many other points have to be studied, and we cannot but think that planters might gain much by comparing the experiences of estate with estate, of district with district. * * *

"In the United States we find most striking examples of the small cost of goods produced on an enormous scale. In South India we shall yet learn that the estate factory cannot long hope to compete with the factory that works for groups of estates, and that the large estate has a great advantage over the small one, provided that the methods, etc., of the one are on all fours with the methods, etc., of the other. Other things being equal, the large estate should not only be able to attain a higher standard of manufacture, but to lay its product down at a lower cost than the small one; and this means that in the strain of competition small estates must in time go to the wall. * * *

"What we would now urge is, that a few leading men should publicly recognize the fact that cost is after all more important than London price. A decline in the latter will do the planter no harm if he can simultaneously bring about a corresponding reduction in the former. To work for high prices, is one way of facing competition; to work for low cost of production, is an infinitely safer one."